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ABSTRACT

Lesson plans for teachers of ninth and tenth grade students contained in this guide are organized according to subject (algebra), instructional topic, career education developmental area, instructional goal, developmental goal, performance objectives, activities, and resource materials. The seven developmental areas of career education are listed and briefly described. Thirty-eight lesson plans are included with such topics as algorithms, solving world problems with whole numbers, application of formulas, formulas and the car, formulas and horsepower, formulas in sports, formulas and the job, laws of inequality, plotting points and graphing, and computer programming. (TA)

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CAREER EXPLORATION 9 – 10

LESSONS IN CAREER EDUCATION

FOR USE IN

ALGEBRA

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September 1975

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BULLETIN #700

CAREER DEVELOPMENT K – 10

CINCINNATI PUBLIC SCHOOLS

CE 015 430

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FOREWORD

This bulletin was written in the summer of 1975 by the teachers named below as an activity of the Career Education Program of the Cincinnati Public Schools. They were advised by Wayne Minnich, Instructional Consultant, in Career Education, Jerome Braun and Roy Matthews, Instructional Consultants in Mathematics. The project was carried out under the general direction of Marlyn Bray, Coordinator of Career Education, and Ralph Shauck, Coordinator of Instructional Services.

Victor Gay	Shroder
Carl Shreve	Gamble
Charles Staley	Schwab
Firmin Widmer	Eastern Hills

During the summer of 1976, Charles Staley of Schwab, Sharleen Gist of Western Hills, and Firmin Widmer of Eastern Hills revised the manual. They were assisted by Roy Matthews, Instructional Consultant in Mathematics. The project was carried out under the general direction of Maxine Watson, Director of the Career Development Program and the Career Staff and Ralph Shauck, Coordinator of Instructional Services.

Approved:

James Jacobs Superintendent of Schools	Raymond Brokamp Assistant Superintendent

INTRODUCTION

As the incorporation of career planning increases in the Cincinnati Public Schools' curriculum, so should the teachers' awareness of how to implement these concepts into their instructional goals. Teachers are encouraged to read these lesson plans and attempt to use them at the appropriate times during the year. It is hoped that teachers will begin to stress the applications of their daily lessons to the areas of Career Development. Teachers should use student oriented activitieis and outside resources to illustrate the relevance of specific topics whenever possible.

Teachers who have found a technique or specific lesson plan which has been successful in relating their specific academic discipline to a career area are asked to share this with the rest of the system. This may be done by outlining the activity and sending it to the Mathematics Office at the Education Center.

SEVEN DEVELOPMENTAL AREAS

Listed below are the seven developmental areas of Career Education. Research has taught us that career development starts in early childhood and continues throughout life. Thus, the seven developmental areas represent a broad sphere in which learning can take place starting at the kindergarten level and reaching to the senior high level.

SELF

Students develop knowledge pertaining to attitudes, feelings, perceptions, and evaluation of self.

INDIVIDUAL AND ENVIRONMENT

Students develop insights into how environments keep people producing, why people work, the relationship between the individual and work, and how people use and modify environments and their resources.

WORLD OF WORK

Students develop understanding of the nature of work, the scope and nature of occupations, methods of studying and classifying occupations and perceptions related to work values.

ECONOMICS

Students develop an understanding of the economic process. This process involves employing human needs. This component emphasizes both the earning of income as a worker and the disposition of income as a consumer.

EDUCATION AND TRAINING

Students develop an awareness of the relationship between education and training and the life roles assumed by oneself.

EMPLOYABILITY AND WORK ADJUSTMENT SKILLS

Students develop patterns of behavior necessary to enter, maintain and to progress in a career. The importance of the development of successful attitude strategies is a vital part of this component.

DECISION MAKING

Students develop decision making skills and understand decision making as a PROCESS that encompasses all of the developmental areas. Students should practice making decisions. They need to gather facts about themselves, jobs, and values, and how to weigh information to reach a conclusion as to what work they are able to do and want to do.

SUBJECT: Algebra - 8AA-9A PLAN I.

INSTRUCTIONAL TOPIC: Significance of Mathematics

DEVELOPMENTAL AREA: World of Work, Self

INSTRUCTIONAL GOAL: To make the student aware that mathematics, specifically algebra, is used in several occupations.

DEVELOPMENTAL GOAL: To have the student examine personal job selections and determine the necessity of algebra and the practicability of the job for the individual.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Become more aware of the presence of algebra in careers. 2. List some careers in which Algebra is used. 3. Make decisions as to the students possibly entering this field as a career. Consider personal traits necessary for specific occupations.	1. Have the student make an oral report on a chosen occupation and the necessary mathematics used in that career. 2. Develop a list of personal qualifications necessary for all jobs. 3. Develop a list of educational qualifications necessary for certain jobs.	1. Library 2. Speakers 3. Field experiences 4. Group discussion 5. *GIS listings of occupations.

*Guidance Information Survey available from school counselor or librarian.

SUBJECT: Algebra - 9th Grade PLAN II.

INSTRUCTIONAL TOPIC: Order of Operation

DEVELOPMENTAL AREA: Decision Making

INSTRUCTIONAL GOAL: To discuss and demonstrate that the order in which arithmatical operations are performed results in different answers--thus the need for a rule.

DEVELOPMENTAL GOAL: To help the student recognize the importance of determining the proper order of steps involved in a decision making activity.

Performance Objectives	Activities	Resource materials
The student should be able to: 1. Recite the rule concerning the "order of operation". 2. Work problems involving several operations.	1. Illustrate by several examples that the order in which arithmetic operations are performed makes a difference. 2. Have the student calculate several problems, e.g., $5 \cdot 2 + 3 \cdot 6$ and $2 + 4 \cdot 5 - 3 + 7 \cdot 10 + 2$. 3. Have the student list activities requiring several steps for completion, e.g., starting a car or following a recipe. Discuss the order of steps. 4. Use a flow chart to demonstrate the importance of order.	1. Bring in several examples of Rube Goldberg's cartoons. (Available through Math Dept. Central Office, T.P.E. materials.)

SUBJECT: Algebra - Grades 8-9 PLAN III.

INSTRUCTIONAL TOPIC: Order of Operation

DEVELOPMENTAL AREA: Decision Making, Self

INSTRUCTIONAL GOAL: To show the student how to evaluate an algebraic expression by doing the proper operation in the correct sequence.

DEVELOPMENTAL GOAL: To decide what method the student will use to solve a problem and gain confidence and efficiency in performance.

Performance Objectives	Activities	Resource materials
The student should be able to: 1. Interpret verbal or written instructions. 2. Develop competence in giving proper instructions. 3. Relate instruction interpretation to performing algebraic manipulations. 4. Demonstrate competence in evaluating expressions, i.e., $(6 - 2) + 27 \div 3 \times (4 + 2)$.	1. Group communication game on giving and taking instructions. 2. List, in flow chart form, the steps to solve a specific arithmetic problem, e.g., 38×15. 3. Have the student produce mathematical expressions to be evaluated, e.g., $(5 + 2) + 6 \times 4 - 2$. 4. Discuss the question "Does the educational sequence of subjects prepare them for their life's occupation?"	1. Activity I.

ACTIVITY I

Have students grouped in pairs. One student will design an arrangement of five geometric figures.

The first student will then describe the arrangement to the other student; only verbal instructions can be used. From these instructions, the second student will try to duplicate the design. After all instructions have been given, the designs should be compared to see the similarity.

Variations:

A. *The second student can ask no questions.

B. The second student can ask only two questions.

C. The second student can ask as many questions as he/she must.

* This is the preferred method.

SUBJECT: Algebra - Grades 8-9 PLAN IV.

INSTRUCTIONAL TOPIC: Algorithms

DEVELOPMENTAL AREA: Decision Making, Self

INSTRUCTIONAL GOAL: To make the student aware that certain rules, algorithms, are necessary to expedite the solutions to problems and to use them properly.

DEVELOPMENTAL GOAL: To show the importance in deciding an outcome and following directions to achieve a desired goal. To determine personal qualities in dealings with others.

Performance Objectives	Activities	Resource materials
The students should be able to: 1. See the need for a rule. $6 + 2 \times 5 \begin{matrix} = 40 \\ = 16 \end{matrix}$. Which is correct? 2. Develop their own rules to govern the results of a made up game. 3. Become proficient in using specific algebraic rules, i.e., working with signed no's., order of operations . . . 4. Teach learned math algorithms to other students. 5. Evaluate their strengths and weaknesses as an instructor.	1. Have groups make up a game and describe the rules to the rest of the class. Try to play the students' game and evaluate the rules to see if the game can really work. 2. Play the games on Mazes and the T.P.E. Nine Stick problem. First without the rules, then give some of the students the rules and have them spread the solutions to other students. 3. Discuss whether rules in society are necessary. 4. Discuss whether companies should regulate the actions of their employees.	1. Mazes. 2. Nine sticks. 3. T.P.E. Vol. 1, Activity I. Activity II.

ACTIVITY I

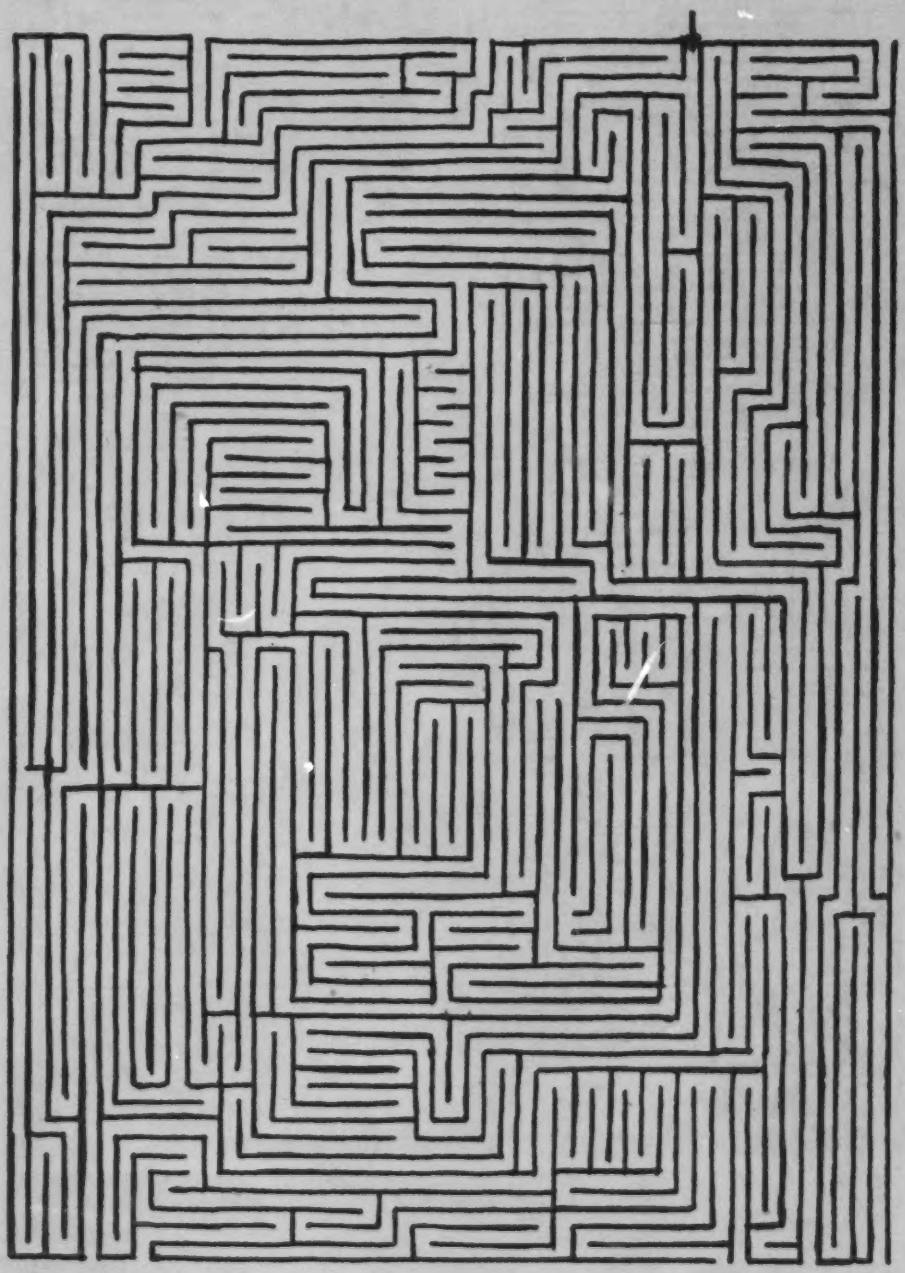
Give the students some mazes to find the path through. After a trial and error method which may not be successful, give the students this method. Begin at start and follow the wall either on the right or the left of the starting position. Follow this wall wherever it goes.

Emphasize the ease of solving the problem once the method of operation is known.

Maze Problem: Grab a Pencil No. 6, Mazes for the Mastermind by Lee Daniel Quinn, Hart Publishing Co., Inc., New York City 10012

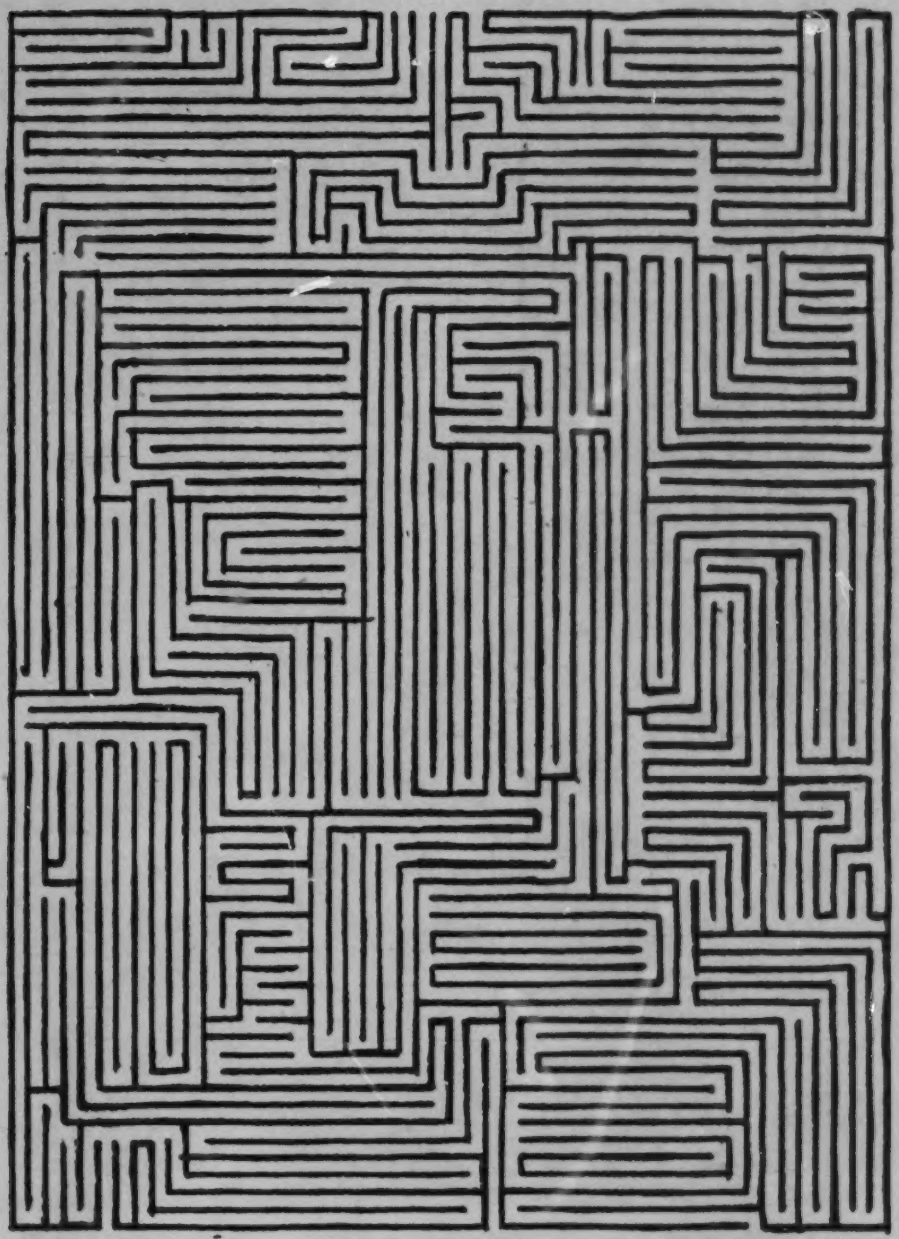
DEAD ENDS

This traditionally-styled labyrinth may look easy at first, but watch out! You'll find most of your paths will go nowhere fast before you can discover the through route. A solution in 12 minutes if fair; 10 minutes is good; and 7 minutes or less is the living end.



Algorithms continued

These long columns won't work wonders for your eyes, but the right ones will lead you to the bottom. Success in 12 minutes is all right; 8 minutes is quite good; and a solution in 6 minutes or less is an eye-opening accomplishment.



Algorithms continued

ACTIVITY II

This model is set up using two students competing against each other. The game is played by the following rules.

1. Each pair of students is given nine (9) objects.
2. Decide which student will go first.
3. On each turn, the student may pick up 1, 2, or 3 objects.
4. The loser of the game is the student who picks up the last stick.

Variations:

This game can be played using 13, 17, or 21 objects, or changing the number of objects which can be picked up at a time, 1, 2, 3, or 4 objects.

Solution:

The rule which will enhance ones chances of winning:

1. Draw 9 lines on a piece of paper - / / / / / / / / /
2. Start at the end and work backwards.
3. Since the person who picks up the last line loses, you take the next to the last line. / / / / / / / (0) /
4. To be sure you take the circled line, you must take the fourth one back from it. Four is one more than the maximum number of lines you are allowed to take in one turn. Continue backwards marking every fourth line until you reach the beginning. / / / (0) / / / (0) /
5. Be sure you take the first circled line. Then take enough lines to make the sum of the ones you take plus your opponent took on his last turn to equal 4.

SUBJECT: Introductory Algebra - Grade 9 PLAN V.

INSTRUCTIONAL TOPIC: Solving Word Problems with Whole Numbers

DEVELOPMENTAL AREA: Self, Decision Making

INSTRUCTIONAL GOAL: To help students acquire a greater understanding and appreciation of solving word problems using equations. To demonstrate certain techniques students might use in writing verbal problems into equations and then solving those equations.

DEVELOPMENTAL GOAL: To provide a setting for students to examine their daily routine and lifestyles for problematic situations and to understand purpose and practice of planning.

Performance Objectives	Activities	Resource materials
The student should be able to: 1. Determine whether a given verbal problem can be solved by either +, -, x, or +. 2. Write an open sentence in terms of the given information and a variable(s). 3. List some problematic situations from his/her own personal situations and derive some method for solution to those problems.	1. Make up a worksheet on elementary word problems, e.g., a clerk in the supermarket must stock a display with 3 cases of pop. Each case contains 24 cans. How many cans of pop would be in the display. 2. Select 4 students to illustrate a solution to a word problem involving addition, subtraction, multiplication, and division. 3. List things which you do on a Saturday. If someone paid you $15.00 to clean up an empty lot, what would you still do and what would you leave undone on a Saturday? Other questions related to planning, lifestyles, use of leisure time can be posed.	1. Bread and Butterflies film on "Me and My Racer".

SUBJECT: Algebra 8AA, Algebra 9A PLAN VI.

INSTRUCTIONAL TOPIC: Scientific Notation

DEVELOPMENTAL AREA: Education and Training

INSTRUCTIONAL GOAL: To help pupils understand the use of exponents in writing very large or very small numbers in scientific notation.

DEVELOPMENTAL GOAL: To develop an awareness of the relationship between education and training and the world of work.

Performance Objectives	Activities	Resource materials
The student should be able to: 1. Write the numerals in scientific notation involving measurements in astronomy, chemistry, and physics. 2. The pupils will identify various problems as those of an astronomer or a physicist.	1. Provide problems in which the numbers are given in standard form and have the pupils write the numbers in scientific notation such as in the following examples. Ex. 1: The mass of the earth is 6,000,000,000,000,000,000,000,000 kilograms. Ex. 2: The mass of a hydrogen atom is 0.000000000000000000000000166 grams. 2. Spend some class time discussing which problems would be solved by the astronomer and which would be solved by an atomic or nuclear physicist. 3. Discuss or have students research the educational requirements necessary to become an astronomer and/or a physicist or related career.	

SUBJECT: Introductor Algebra - Grade 9 PLAN VII.

INSTRUCTIONAL TOPIC: Integers

DEVELOPMENTAL AREA: Self, Individual and Environment

INSTRUCTIONAL GOAL: To develop the concept of positive and negative integers.

DEVELOPMENTAL GOAL: To allow each student to examine and extend his/her criteria in choosing a probable career or careers for the future (after graduation).

Performance Objectives	Activities	Resource materials
The student should be able to: 1. Identify the pos/neg idea from a problem situation. 2. Give some examples of the usage of integers. 3. Identify the positive and negative integers in a number line. 4. Select 2 or 3 probable careers which interest the student and complete a table on career characteristics.	1. Discuss the concept of positive and negative using directed rays. 2. Have students draw number-lines, labeling positive and negative integers in their proper phase. 3. Have students bring in and discuss examples of areas where integer concepts are used (pos-neg). a. land elevation b. football c. thermometers d. banking accounts? e. negative income tax (teacher should explain (d) and (e). 4. Have students select at least one probable career which interests them, and based on that career, complete Tables I and II below on career characteristics.	

Integers continued

TABLE I.

Social

	alone				a lot	
-	2	1	0	1	2	+

Social - degree of contact with people

Travel

	little				a great deal	
-	2	1	0	1	2	+

Money

	little				a great deal	
-	2	1	0	1	2	+

TABLE II. (Career requirements to be investigated by each student)

Working Conditions

	Outdoors				Indoors	
-	2	1	0	1	2	+

	Physical				Mental	
-	2	1	0	1	2	+

Creativity

	Plan				Execution	
-	2	1	0	1	2	+

Work Hours

	Regular				Irregular	
-	2	1	0	1	2	+

SUBJECT: Introductory Algebra - Grade 9 PLAN VIII.

INSTRUCTIONAL TOPIC: Application of Formulas

DEVELOPMENTAL AREA: World of Work

INSTRUCTIONAL GOAL: To show students how to read, to write, to evaluate and to apply formulas.

DEVELOPMENTAL GOAL: To help students discover various job areas where certain formulas are used.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Read formulas. 2. Understand what each variable represents. 3. Evaluate formulas. 4. List 5 occupations and the math used in that employment.	1. Pass out worksheet on simple formulas and discuss with the class the meaning of the formulas. 2. Use class discussion to develop a flow chart to guide in writing formulas. 3. Lead class in listing certain formulas which can be matched to certain job areas. 4. Assign students projects to investigate job areas associated with the match formula.	1. Applications in Math, Course A, Johnson, Hansen, Peterson. 2. Problem solving with the computer by Edwin R. Sage, Entelek Corp.

FORMULAS

A. Devise a series of word problems whereby student can easily derive formulas.

B. Show and let students evaluate formulas.

C. List certain formulas which can be matched to certain job areas (about 10-20).

See pp. 103-105, 199-202, 425-427, 289-292, Using Algebra text.

See pp. 374-376, Holt Algebra 1.

Possible areas:

a. Nurse
b. Engineering (be specific)
c. Carpenter
d. Payroll clerk
e. Sports Statician
f. Electrician

$$E = IR$$
$$Q = 1/2\ RI^2$$

g. Photographer

$$\left(\frac{1}{f} = \frac{1}{u} + \frac{1}{v}\right)$$ p. 400

h. Physicist

SUBJECT: Algebra 8AA - Algebra 9A PLAN IX.

INSTRUCTIONAL TOPIC: Temperature Formulas

DEVELOPMENTAL AREA: Education and Training

INSTRUCTIONAL GOAL: To help pupils understand how to use formulas in changing temperature readings on one scale to the other.

DEVELOPMENTAL GOAL: To develop an awareness of the relationship between education and training and the world of work.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Change the reading on one scale to the other. Given the formulas: $C = 5/9\ (F - 32)$ and $F = 9/5\ C + 32$ 2. Algebraically derive one formula from the other. 3. Compare the educational requirements between a lab technician and a chemist.	1. Provide problems in changing temperature readings from one scale to the other. Include both positive and negative temperature readings from both scales. 2. Discuss the fact that with a knowledge of algebra it is necessary to have only one of the two formulas. The other one can be derived algebraically. 3. Discuss the educational requirements for a chemist and/or a laboratory technician. 4. Draw side by side thermometers comparing the Celsius and Farenheit scales.	1. G.I.S. program.

SUBJECT: Algebra 8AA - Algebra 9A PLAN X.

INSTRUCTIONAL TOPIC: Density

DEVELOPMENTAL AREA: Education and Training

INSTRUCTIONAL GOAL: Pupils will use the formula for density to determine the mass of various substances.

DEVELOPMENTAL GOAL: To develop an awareness of the relationship between education and training and the world of work.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Determine the mass of various substances, given a table of densities and the formula relating density, mass, and volume. 2. List two colleges which grant degrees in applied science and how many years of mathematics they require.	1. Provide information and problems such as those on the worksheet on the following page. 2. Discuss briefly the job of physicists by listing some of the fields in which they study and work. 3. Discuss briefly or have pupils do a report on the mathematics requirements of two colleges which grant degrees in applied science.	1. G.I.S. program.

Density continued

PROBLEM:

The density of a substance is a property of matter which is given by the formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

or, in symbols:

$$d = \frac{M}{V}$$

Table of densities of some common substances:

Substance	Density (grams per cubic centimeter)
Water	1
Aluminum	2.7
Iron	7.9
Lead	11.3
Gold	19.3

Use the above formula and table to work the following problems.

1. What is the mass of a cube of iron with sides of length 2 cm?
2. A sphere of aluminum has a radius of 10 cm. What is the mass?
3. A pipe with a diameter of 10 cm contains a column of water 10 meters high. What is the mass of the water?
4. What is the difference in mass between two spheres (each with radius = 5 cm), one of which is lead and one of which is gold?

SUBJECT: Algebra - Grade 9 PLAN XI.

INSTRUCTIONAL TOPIC: Fractions

DEVELOPMENTAL AREA: Individual and Environment

INSTRUCTIONAL GOAL: To develop the concept of a fraction and to show the value of fractions.

DEVELOPMENTAL GOAL: To show the students a relevance in their knowledge of fractions and the uses of fractions in everyday situations.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Give examples of the use of fractions in daily living. 2. Identify the numerator and denominator.	1. Have the teacher put examples of fractions on the board. 2. Have students bring in musical instruments and demonstrate that 2 notes harmonize if the ratio of their frequencies is a simple fraction. 3. Have students bring newspaper advertisement showing fractions.	1. Musical Instruments 2. Oscilloscope

SUBJECT: Introductory Algebra - Grade 9 PLAN XII.

INSTRUCTIONAL TOPIC: Linear Equations

DEVELOPMENTAL AREA: World of Work, Decision Making

INSTRUCTIONAL GOAL: To study and analyze in detail three classes of solutions for equations in the form $Ax + B = C$ by writing flowcharts describing the steps in the solution.

DEVELOPMENTAL GOAL: To show students how linear equations are solved using computers and to show how flow charts are used in business and scientific applications.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve most linear equations successfully. 2. Identify and categorize solution to linear equation of the form $Ax + B = C$ as either unique, no real number, or any real number. 3. Write a detailed flow chart and how to solve the linear equation $Ax + B = C$.	1. Review Solving Linear Equations. 2. Assign problems from pages 94, 95 of Using Algebra. 3. Use Chapter 4, "Algebra and the Computer" (page 99-136 in Problem Solving with the Computer by Edwin R. Sage, as a model and guide in relating flow charting with solving linear equation. This flow charting should be done as a class discussion. 4. Allow students to write programs, (flow charts) of some of the problems on pages 102-103 Ibid.	1. Using Algebra Publ. Laidlow. 2. Problem-Solving with the Computer by Edwin Sage, published by Entelek.

SUBJECT: Introductory Algebra - Grade 9 PLAN XIII.

INSTRUCTIONAL TOPIC: Formulas and the Car

DEVELOPMENTAL AREA: Economics, Individual and Environment

INSTRUCTIONAL GOAL: To give the student further practice in using and evaluating formulas.

DEVELOPMENTAL GOAL: To encourage students to think of certain formulas that might be associated with the usage of the car and how they affect their finances and the world in which they live.

Performance Objective	Activities	Resource Materials
The student should be able to: 1. List some problem situations which are associated with the use of the car. 2. Understand the formulas derived from the problem siutations around the car. 3. Solve and evaluate derived formulas.	1. Have the student list problem situations which are associated with the car. For instance: a. buying gas b. gas mileage c. buying and paying for a car d. speed and distance e. braking time and distance f. car repair, parts/labor g. tires, car wash h. insurance 2. Enumerate how people can better cope with the problems these items pose. 3. Make a chart/poster illustrating expenses to own, operate, and maintain a given car under specified usage.	1. Contact oil companies for publications on cars. 2. Newspaper clippings on sale items related to cars. 3. Insurance rates chart.

SUBJECT: Algebra 8AA - Algebra 9A PLAN XIV.

INSTRUCTIONAL TOPIC: Formulas and horsepower

DEVELOPMENTAL AREA: World of Work

INSTRUCTIONAL GOAL: To give the student the opportunity to see how mathematics is used in determining the horsepower ratings of motors.

DEVELOPMENTAL GOAL: To develop an awareness of the relationship between school and work

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve various problems relating to horsepower, given the formula.	1. Provide information and problems such as those on the worksheet on the following page. 2. Provide an opportunity for pupils to do further research on how to determine horsepower. Some of them may wish to study about the horsepower rating of automobiles. 3. Discuss the fact that the world of work as it relates to the problems about elevators, car engines, etc. depends on a knowledge of certain concepts in mathematics.	1. Automotive magazine.

Horsepower continued

James Watt, the inventor of the steam engine, was the first to use the idea of horsepower. He found that a London draft horse was capable of doing work equivalent to lifting 33,000 pounds 1 foot in 1 minute. He used this as a basis of comparison for his engines and this has been universally adopted.

Horsepower is a measure of the rate at which work is performed and is given by the formula:

$$\text{horsepower (hp)} = \frac{\text{force x vertical distance}}{550 \text{ x number of seconds}}$$

or

$$\text{horsepower (hp)} = \frac{\text{force x vertical distance}}{33{,}000 \text{ x number of minutes}}$$

Problems:

1. An elevator motor must lift 10,000 lb. a distance of 50 ft. in $\frac{1}{4}$ min. What is the horsepower rating of this motor?

2. How many horsepower are required to lift an elevator weighing 4 tons to the top of a building 240 ft. high in $1\frac{1}{2}$ min.

SUBJECT: Algebra - Grades 8-9

Plan XV.

INSTRUCTIONAL TOPIC: Formulas Used in Auto Design

DEVELOPMENTAL AREA: World of Work

INSTRUCTIONAL GOAL: To familiarize the student with specific formulas and their solution.

DEVELOPMENTAL GOAL: To show the students the importance of mathematics and how it may be used in specific jobs.

Performance Objective	Activities	Resource materials
The student should be able to: 1. List 3 occupations using the formulas in this lesson. 2. Solve the formulas for specific variables. 3. Set up a chart of educational requirements and institutions in the field of auto design.	1. Have the student do reports on the following items. (Describe these) a. work b. power c. horsepower d. water power e. brake horsepower f. SAE horsepower g. engine displacement h. rear axle ratio 2. Bring in ads from the newspaper showing jobs available in the automotive industry.	1. Newspaper. 2. Library and automotive vocational classes.

Work

$$w = f \times s$$

w = work in foot-lbs.
f = force in lbs.
s = distance in feet

$$P = \frac{W}{t} \text{ or } P = \frac{fs}{t}$$

w = work f = force
t = time s = distance

Horsepower

$$hp = \frac{\text{ft-lb of work per sec.}}{550}$$

or

$$hp = \frac{\text{weight-lb x vertical distance in ft.}}{550 \text{ x number of sec.}}$$

Water Power

$$hp = \frac{Fd \times 62.4}{550}$$

F = flow in cu.ft./sec.
d = distance water falls in ft.

Brake Horsepower

$$bhp = \frac{2\pi RNW}{33{,}000}$$

R = length of arm
N = speed of engine in rpm
W = load in pounds

S.A.E. Horsepower

(SAE) Society of Automotive Engineers

$$S.A.E.\ hp = \frac{D^2 \times N}{2.5}$$

D = diameter of cylinder or bore
N = number of cylinders

Engine Displacement

$d = \pi r^2 \times$ stroke x no. cylinders

Rear-Axle Ratio

$$r = \frac{T}{t} \text{ or } T = rt$$

r = ratio
T = No. of teeth in ring gear
t = No. of teeth in pinion gear

SUBJECT: Algebra - Grades 8-9 PLAN XVI.

INSTRUCTIONAL TOPIC: Distance Formula

DEVELOPMENTAL AREA: Individual and Environment, Decision Making

INSTRUCTIONAL GOAL: To be able to solve for any variable in the formula $D = rt$.

DEVELOPMENTAL GOAL: To have the student develop an awareness of his/her place in the environment and through mathematics how to solve existing problems.

Performance Objective	Activities	Resource Materials
The student should be able to: 1. Solve for any variable in the formula $d = rt$. $d = rt$ $\frac{d}{r} = t$ $\frac{d}{t} = r$ 2. List 10 jobs or problems encountered in setting up a mass transit system.	1. Have the student determine the distance from his/her home to school by some method, e.g., bus mileage car mileage bicycle mileage (to the nearest .1 of a mile.) 2. Have the student determine the time required to get to school (to nearest minute). 3. Have the student determine his/her rate of speed in getting to school. 4. Discuss the practical, economic, and environmental implications of their method of transportation and the advantages or disadvantages in the future.	1. Secure a speaker from an auto club to discuss trip planning. 2. Have a sports car enthusiast with rally racing experience discuss the distance problem in racing statistics.

SUBJECT: Introductory Algebra - Grade 9 PLAN XVII.

INSTRUCTIONAL TOPIC: Formulas in Sports

DEVELOPMENTAL AREA: World of Work, Education and Training

INSTRUCTIONAL GOAL: To show the student the relationship between formulas and sports.

DEVELOPMENTAL GOAL: To help the student investigate sports areas that use formulas and discover what other training and preparations are needed to participate.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve a formula of 3 variables when the values of two variables are known. 2. Solve a formula of 4 variables when the values of three variables are known. 3. Discover sport areas which use formulas.	1. Discuss with the class the favorite sports they like to watch and participate. Tabulate the top five. 2. List a formula next to each sport area. a. Baseball $a = \frac{h}{b}$ a = Bat. Av. h = hits b = # at bats b. $e = \frac{9r}{i}$ (Baseball) <-----> e = earned run average r = runs i = innings c. Football $p = \frac{c}{a}$ p = passing percentage c = completed passes a = attempted passes d. Basketball $f = \frac{c}{a}$ f = field goal percentages c = completed shots a = attempted shots e. Bowling f. Golf 3. Have students write reports.	1. See Applications in Math, published by Scots Foresman. 2. Information about sports figures from the newspaper or sports organizations.

SUBJECT: Introductory Algebra - Grade 9 PLAN XVIII.

INSTRUCTIONAL TOPIC: Formulas and the Job

DEVELOPMENTAL AREA: Economics, Self

INSTRUCTIONAL GOAL: To demonstrate how formulas might be used in determining salaries.

DEVELOPMENTAL GOAL: To help each student examine various ways of computing a salary and investigate his/her preference.

Performance Objective	Activities	Resource materials
The students should be able to: 1. Write formulas for various ways incomes are determined. 2. Evaluate problems involving salary formulas. 3. Select a particular method of computing an income and give some reasons for this preference.	1. Discuss various ways some salaries are determined, e.g. piece rate, hourly, yearly, commission, (a specific combination). 2. Make worksheet on salary formulas to have the student calculate these wages. 3. Have each student write a short, but concise, paragraph supporting his preference of method of receiving an income, e.g., commission--because the amount of money you earn can be unlimited. 4. Tabulate class preference of method of receiving a salary.	1. Consult personnel office of various companies.

SUBJECT: Algebra - Grade 9 PLAN XIX.

INSTRUCTIONAL TOPIC: Ratio

DEVELOPMENTAL AREA: Self, Education and Training

INSTRUCTIONAL GOAL: To develop the concept of comparing one number with another through division.

DEVELOPMENTAL GOAL: To improve one's self-image by viewing events in our lives in relation to our life experiences.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Give examples of ratios 2. Recognizing certain common units as ratios.	1. The student should mention some frustration that he experienced during the week relating his feelings and attitudes to the event as it happened. Compare these immediate reactions to his frustrations to long range feelings he may have about the event next week or next year. 2. Discuss useful ratios such as: miles per hour, prices per unit, etc. 3. Set up time ratios similar to the following:	1. Newspapers showing prices and other useful ratios.

Ratio and Proportion continued

$$\frac{\text{time in school (day)}}{\text{awake hours (day}} \longrightarrow \frac{\text{week}}{\text{week}}$$

$$\frac{\text{time asleep (day)}}{\text{time awake (day)}} \longrightarrow \frac{\text{week}}{\text{week}} \longrightarrow \frac{\text{their life so far}}{\text{their life so far}}$$

$$\frac{\text{(1 hr/day) time in math (day)}}{\text{time in school (day) (6 hr/day)}} \longrightarrow \frac{\text{week}}{\text{week}} \longrightarrow \frac{\text{180 days}}{\text{180 days}}$$

$$\frac{\text{years of school}}{\text{years of employment}}$$

$$\frac{\text{years of school}}{\text{years of life expectancy}}$$

$$\frac{\text{years of employment}}{\text{years of life expectancy}}$$

These ratios and many others may be found and illusted on a time line.

SUBJECT: Introductory Algebra - Grade 9 PLAN X...

INSTRUCTIONAL TOPIC: Laws of Inequality

DEVELOPMENTAL AREA: Education and Training

INSTRUCTIONAL GOAL: To help the students understand the laws of inequality, especially what happens when inequalities are multiplied by negative equalities.

DEVELOPMENTAL GOAL: To prepare students to become aware of the possibilities and the necessities to change jobs several (2 to 3) times throughout their lifetimes. To help students realize that real world situations are often evaluated in terms of "less than", "greater than" and "approximately".

Performance Objective	Activities	Resource materials
The student should be able to: 1. State and write the laws of inequalities from memory. 2. Use laws to solve inequalities; e.g. from: $ax > b$; $ax \leq b$ $ax + b > c$; $ax + b \leq c$ Case I $a > o$ Case II $a < o$ 3. Discover from a class study of some jobs, the need to become flexible in job selection. 4. List other job spin-offs which might generate from this student's initial job selection.	1. Discuss laws of inequality. 2. List problems, have student match the law that the problem exemplify. 3. Have student interview older friends and relatives who have changed jobs several times and write a summary of job changes. 4. Tabulate and make a chart of the reasons for job changes. 5. Develop class project pointing out possible job spin-offs from one given job. Then have students use their preferred job to generate other possible and related jobs they might enter if their chosen job is not in such demand or available.	1. Interest inventory survey. (This can be used to illustrate the greater and less than traits necessary for specific job areas.

INTEREST INVENTORY

Directions: Indicate your preference according to the following table:

2 - I like very much 1 - I like moderately 0 - I am indifferent
-1 - I dislike moderately -2 - I dislike very much

1. Sketch pictures of objects ____
2. Design styles for clothing ____
3. Play a musical instrument ____
4. Act in a play ____
5. Instruct classes of students ____
6. Work as a librarian ____
7. Direct traffic ____
8. Take care of pets ____
9. Plan and design bridges ____
10. Make change and cash checks ____
11. Type letters and reports ____
12. Make collections from customers ____
13. Talk to customers about complaints ____
14. Sell furniture in a store ____
15. Sell magazines or cosmetics door to door ____
16. Conduct tours and act as a guide ____
17. Do repair work at a service station ____
18. Cook in a restaurant ____
19. Order food supplies for a hotel ____
20. Work in a nursery school ____
21. Work as a waiter or waitress ____
22. Take care of shrubs and flowers ____
23. Work on a farm ____
24. Drive a truck ____
25. Repair radios ____
26. Paint or do paper hanging inside a house ____
27. Sew clothes ____
28. Letter posters ____
29. Sort articles by size and color ____
30. Operate a cash register in a grocery store ____

List the most liked activities and determine the underlying reason why. Do the same for the most disliked activities.

SUBJECT: Algebra - Grade 9 PLAN XXI.

INSTRUCTIONAL TOPIC: Direct and Inverse Variation

DEVELOPMENTAL AREA: World of Work, Education and Training

INSTRUCTIONAL GOAL: To develop the concept of direct and inverse variation.

DEVELOPMENTAL GOAL: To have students compare certain job characteristics in terms of whether they are directly or inversely related.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Determine if a relation is direct or indirect. 2. Find the constant of proportionality. 3. Solve direct and indirect variation problems. 4. Establish a personal hierarcy of values related to job characteristics.	1. Shine a flashlight on the wall comparing the distance to the wall to the diameter of the circle. 2. Use magnets on a table comparing force with mass of iron object. 3. Plot graphs showing direct and inverse relations. 4. Discuss whether the following paired items illustrate direct or inverse variations. a. Job satisfaction vs. salary b. Self image vs. importance of one's work c. tranquility of job vs. responsibility of job d. job satisfaction vs. job environment: e.g., people, fringe benefits, place of employment, transportation, etc.	

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials
	e. Self-image vs. productivity f. Aptitude vs. productivity g. Tranquility vs. job security 5. Have students rank job characteristics according to importance to them. 6. Tabulate class results.	

SUBJECT: Algebra - Grade 9 PLAN XXII.

INSTRUCTIONAL TOPIC: Relations and Functions

DEVELOPMENTAL AREA: Individual and Environment, Employability and Work Adjustment

INSTRUCTIONAL GOAL: To develop the concept of relation and function.

DEVELOPMENTAL GOAL: To demonstrate the use of the grid of a map to become familiar with ones environment. To help students become aware how one job depends on another.

Performance Objective	Activities	Resource materials
The student should be able to:	1. Illustrate many relations showing the domain and the range.	1. Maps with grids
1. Graph a relation.		
2. Determine the domain and the range of a relation.	2. Illustrate a function.	
3. Determine if a relation is a function.	3. Graph functions and relations.	
4. Give the inverse of a relation.	4. Discuss the use of a grid on a map to help one in locating places in his environment, e.g., choose a manufactured product and locate on a world map the raw materials necessary for that product and the related manufacturing centers, e.g., telephone--plastic, copper for wire, rubber for cord coating, paint metal . . .	
5. Identify independent and dependent variable.		
6. List 10 related or influenced occupations from a chosen occupation.	5. List jobs that depend on other jobs.	

SUBJECT: Algebra - Grades 8-9 PLAN XXIII.

INSTRUCTIONAL TOPIC: Interest Formula

DEVELOPMENTAL AREA: World of Work, Employability and Work Adjustment

INSTRUCTIONAL GOAL: To be able to solve the interest formula $I = P\ r\ t$ for any variable.

DEVELOPMENTAL GOAL: To make the student aware that any one formula may be used in several different employment areas and in several different forms.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Understand the meaning of each variable in the formula $I = P\ r\ t$. 2. Use algebraic manipulations to transform the formula into the following: $P = \frac{I}{rt}$, $r = \frac{I}{Pt}$, $t = \frac{I}{P\ r}$ 3. Solve the formula for the missing variable given any set of data. 4. List 4 occupations which use this formula.	1. Discuss jobs using interest. 2. Distribute newspapers to find where interest or percentage is used. 3. Solve selected problems directly from the newspaper. 4. Discuss how the knowledge of one formula may be used in several different job areas.	1. Newspapers. 2. Speaker from local savings establishment to elaborate on the complexities of the formula. 3. Business math teacher who can speak to the class on the use of formulas in business math.

SUBJECT: Algebra Grade 8AA - Grade 9A PLAN XXIV.

INSTRUCTIONAL TOPIC: Formulas

DEVELOPMENTAL AREA: Education and Training, World of Work

INSTRUCTIONAL GOAL: To solve various formulas for a specified variable.

DEVELOPMENTAL GOAL: To develop an awareness of the relationship between education and training and the world of work.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve various formulas for a specified variable.	1. Solve formulas for the indicated variable. In the business world, one formula which is commonly used is $I = PRT$. I = interest; P = principal; R = rate; T = time in years. Since there are four variables, there are four formulas. $P = \frac{I}{RT}$; $R = \frac{I}{PT}$; $T = \frac{I}{PR}$. In actual practice, it is only necessary to memorize one of the formulas. The others can be derived algebraically.	1. Consult local bank for interest tables.

Formulas continued

1. Using the formula $I = PRT$, derive a formula for R.

2. $C = 5/9\ (F - 32)$ is the formula used to convert a temperature on the Fahrenheit scale to one on the Celsius scale. Solve the formula for F.

3. The formula for the density of a substance is $d = \frac{M}{V}$. d = density, M = mass, V = volume. Solve the formula for V and for M.

4. $D = RT$ is the formula which relates distance, rate, and time. Derive a formula for the rate.

5. $hp = \frac{FV}{550\ t}$ is the formula for computing horsepower.

   hp = horsepower, F = force or weight, V = vertical distance and t = number of seconds. Solve the formula for F.

SUBJECT: Algebra - Grades 8AA - 9A PLAN XXV.

INSTRUCTIONAL TOPIC: Proportions

DEVELOPMENTAL AREA: Employability and Work Adjustment Skills

INSTRUCTIONAL GOAL: To help pupils understand the use of proportions in making solutions in a medical laboratory.

DEVELOPMENTAL GOAL: To develop an awareness of the need for job skills.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve problems about mixing solutions with proportions. 2. List the courses in high school mathematics that are required for a medical/ laboratory technician.	1. Provide some background information on medical laboratories after having discussed ratio and proportion. 2. Have pupils visit one of the medical laboratories in the vocational annex of one of the area high schools. Let them talk with the students and/or teacher in the laboratory concerning the skills and education requirements. 3. Complete the Worksheet I on the following page. 4. Discuss other applications of proportions as illustred on Worksheet II.	1. Nursing schools and medical school.

WORKSHEET I.

Example:

A formula calls for 5 grams of sodium chloride per 1000 milliliters of solution. If only 500 milliliters of the solution is needed, how much sodium chloride is needed?

Let X = the number of grams of sodium chloride needed. Then set up the following proportion and solve.

$$\frac{5\ g}{1000\ ml} = \frac{X g}{500\ ml} \qquad X = (500\ ml)\ \frac{5\ g}{1000\ ml}$$

Solve the following by the use of proportions.

1. A formula calls for 8 grams of sodium chloride per 1000 milliliters of solution. If only 500 milliliters of the solution is needed, how much sodium chloride is needed?

2. A solution is needed which requires 6 grams of sodium hydroxide per 1000 milliliters of solution. If only 300 milliliters of the solution is needed, how much sodium hydroxide should be used?

WORKSHEET II.

The relationship between the diameters of the pulleys and the speeds of the pulleys is given as follows:

$$\frac{\text{Speed of driven pulley (s)}}{\text{Speed of driving pulley (S)}} = \frac{\text{Diameter of driving pulley (D)}}{\text{Diameter of driven pulley (d)}}$$

or

$$\frac{s}{S} = \frac{D}{d}$$

Use this proportion to solve the following problems.

1. A driven pulley with a diameter of 15 inches and a speed of 600 rpm is connected to a driven pulley which has a diameter of 5 inches. What is the speed of the driven pulley?

2. A grinder which is driven by a bolt is supposed to run at 3000 rpm. The pulley on the grinder has a diameter of 3 inches. If the motor being used to drive the grinder runs at 1800 rpm, which size pulley should be used on the motor?

Use a proportion also for this problem.

3. A solution is needed which requires 5 grams of potassium hydroxide per 1000 ml of solution. How much potassium hydroxide is needed for 400 ml of the solution?

SUBJECT: Algebra - Grades 8-9 PLAN XXVI.

INSTRUCTIONAL TOPIC: Work Problems

DEVELOPMENTAL AREA: Economics; Self

INSTRUCTIONAL GOAL: To be able to understand and solve work problems.

DEVELOPMENTAL GOAL: To understand the increased efficiency and economic benefits of completing a job by working together or alone.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve work problems algebraically. 2. List five advantages of working with someone on a problem. 3. Decide if you work better alone or with a group.	1. Have students set up in teams to count a specific amount of play money. 2. Teams should be made up of 1 person 2 people 3 people 4 people 3. Determine which working situation was the most productive per person involved and why.	1. Try to get a time study coordinator from an industrial area to elaborate on the subject of job efficiency.

SUBJECT: Algebra - Grades 8-9 PLAN XXVII.

INSTRUCTIONAL TOPIC: Mixture problems

DEVELOPMENTAL AREA: World of Work, Individual and Environment

INSTRUCTIONAL GOAL: To have the student read, understand, and solve mixture problems.

DEVELOPMENTAL GOAL: To show the relevance of mixture problems and their vast use in technical and practical areas.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Understand mixture problems. 2. Set up and solve mixture problems. 3. List two occupations which might use mixture problems.	1. Have the art teacher show how to mix paint pigments to get different colors. 2. Have students mix anti-freeze and water and estimate the change in the freezing point of the water (do as a demonstration for the class).	1. Speaker from the vocational areas of nursing or medicine where mixtures are used. 2. Art teacher to show paint mixing technique.

SUBJECT: Algebra - Grade 9 PLAN XXVIII.

INSTRUCTIONAL TOPIC: Relations

DEVELOPMENTAL AREA: Individual and Environment

INSTRUCTIONAL GOAL: To help the student understand the concept of relation as a set of ordered pairs.

DEVELOPMENTAL GOAL: To examine a model of population explosion and its effect on the total environment.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Explain the definition of a relation. 2. Give examples of a relation identifying the range and domain.	1. Play the game "Life". Place a pattern of counters on a checker board which represents persons. Some of these "people" will survive or die and some will be born according to the following "genetic" laws. In the following laws, the term neighbor is defined as two which are either adjacent to one another or whose corners touch. a. Survivals: Every counter with 2 or 3 neighboring counters survives for the next generation. b. Deaths: Each counter with 4 or more neighbors dies from overpopulation. Every counter with one neighbor or less dies from isolation. c. Births: Each empty cell with 3 neighboring counters	1. Graph paper. 2. Counters.

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

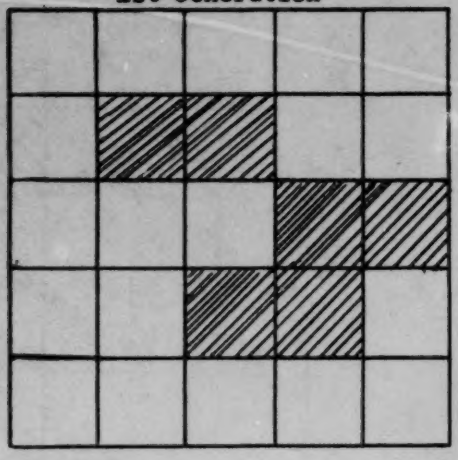
INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

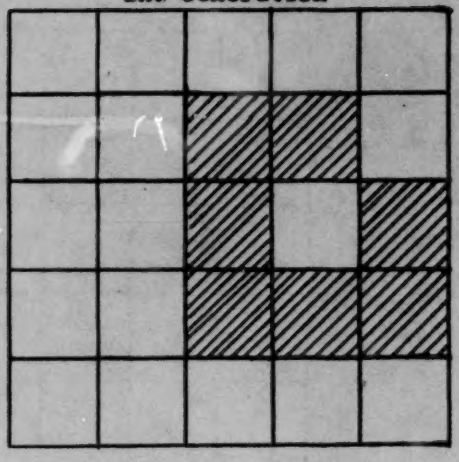
Performance Objective	Activities	Resource materials
	is a birth cell. A counter is placed on it in the next generation. Some patterns will become stable; some die and some "blink". See example. 2. Compare results of this game to population problems of today, e.g., "fleeing to the suburbs", "death of the inner city". 3. Discuss the importance of mathematical models in solving problems in other disciplines. 4. Discuss how the rules of this game generate a relation which is not a set of ordered pairs of numbers, but an ordered pair of patterns of counters.	

EXAMPLE I. STABLE PATTERN

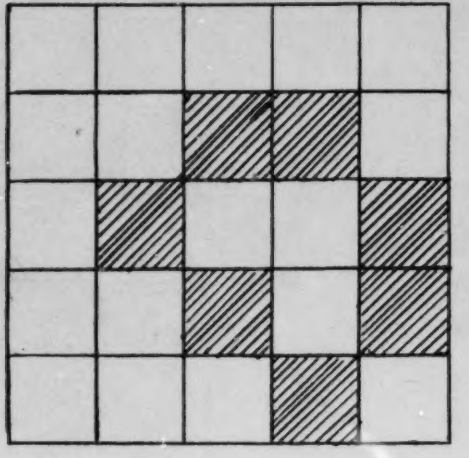
1st Generation



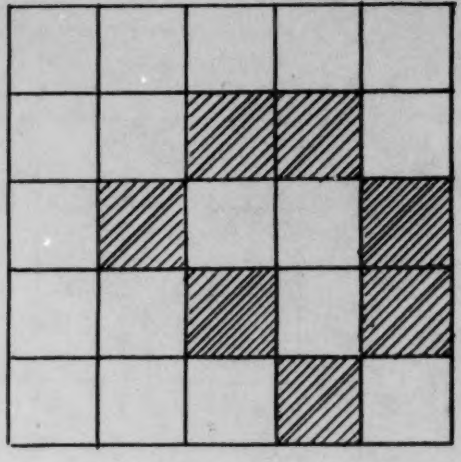
2nd Generation



3rd Generation

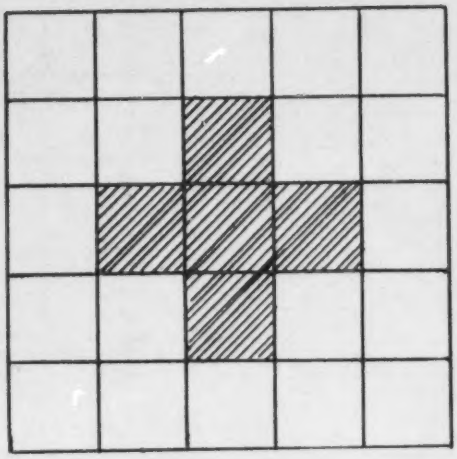


4th Generation

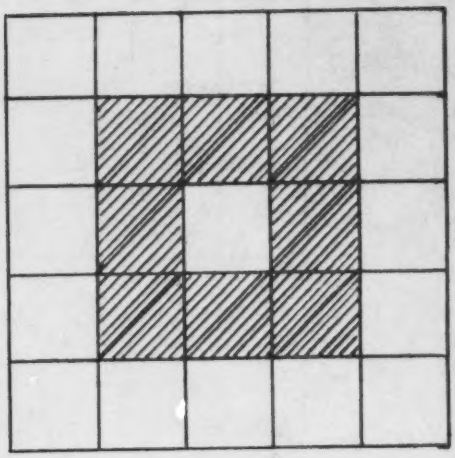


EXAMPLE II. BLINKING PATTERN

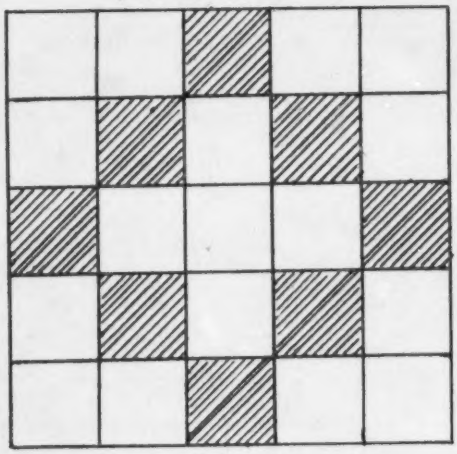
1st Generation



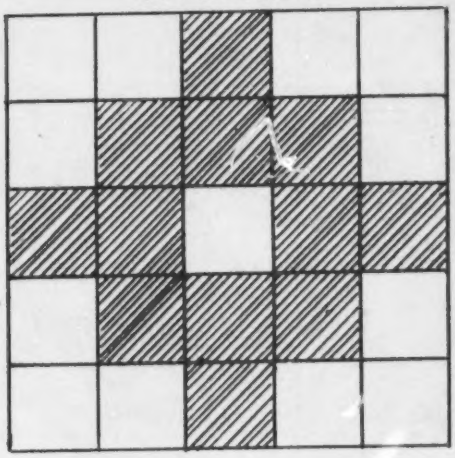
2nd Generation



3rd Generation

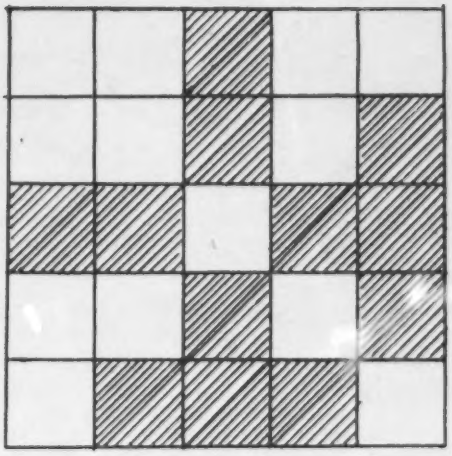


4th Generation

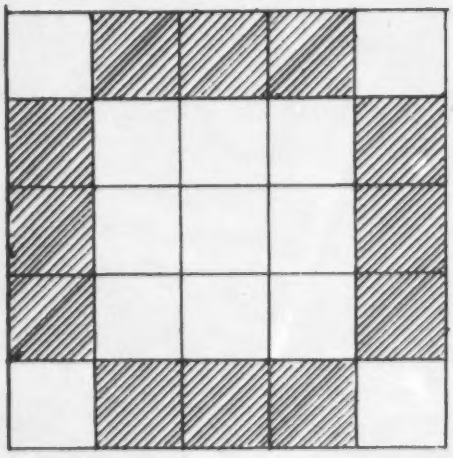


EXAMPLE II. BLINKING PATTERN continued

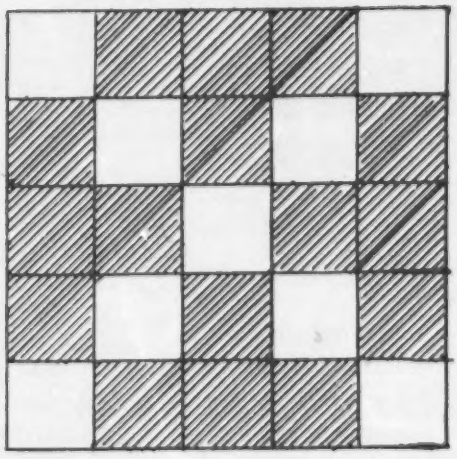
5th Generation



6th Generation



7th Generation



SUBJECT: Algebra - Grades 8-9 PLAN XXIX.

INSTRUCTIONAL TOPIC: Plotting Points and Graphing

DEVELOPMENTAL AREA: World of Work

INSTRUCTIONAL GOAL: To be able to interpret any graph, set up the graph scales, and plot points on a graphing system.

DEVELOPMENTAL GOAL: To realize the vast use of graphs in job areas and to better understand their set-up and use.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Recognize the scales used on a graph. 2. List 5 occupational areas that use graphs. 3. Interpret a graph. 4. Set up cartesian coordinate system and plot several points.	1. Have every student bring in a graph and explain its use and the career related field. 2. Discuss why visual understanding is better than written instruction.	1. Any source of graphing examples, newspapers, magazines, including picture, bar, broken line, circle.

SUBJECT: Algebra - Grade 9 PLAN XXX.

INSTRUCTIONAL TOPIC: Slope of a Line

DEVELOPMENTAL AREA: World of Work

INSTRUCTIONAL GOAL: To define the slope of a line.

DEVELOPMENTAL GOAL: To relate the concept of a slope of the line to the work of a carpenter in building a stairway.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Define the slope of a line. 2. Evaluate from a graph of a line its slope. 3. Draw lines with given slopes. 4. Determine the slope of a stairway from its "riser" and "tread". 5. Design a stairway given the height, width and number of desired steps.	1. Measure "riser", "tread" and number of steps in the outside and inside of school and in their homes. 2. Talk by visiting carpenter illustrating the use of his tools in making the stairs. 3. Visit to some construction site where stairs are being made.	1. Graph paper.

SUBJECT: Algebra - Grade 9 PLAN XXXI.

INSTRUCTIONAL TOPIC: Systems of Linear Equations

DEVELOPMENTAL AREA: Individual and Environment

INSTRUCTIONAL GOAL: To solve a set of simultaneous equations.

DEVELOPMENTAL GOAL: To appreciate the interaction of many environments with the individual.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Realize the influence of environment on our behavior. 2. Understand that the solution to simultaneous equations is the intersection of the truth set of each equation.	1. Define simultaneous equations. 2. Solve and graph some examples. 3. Define environment. 4. List and discuss all the environments of which we are members such as: a. neighborhood b. work c. school d. national e. religious or moral f. ethnic g. home 5. List the obligations imposed by each of these environments and the support provided by each to the individual.	1. Psychologist to discuss the effect of environment on the individual.

SUBJECT: Algebra - Grade 9 PLAN XXXII.

INSTRUCTIONAL TOPIC: Factoring the difference of two squares.

DEVELOPMENTAL AREA: Decision Making

INSTRUCTIONAL GOAL: To have students recognize and factor the differences of two squares. To stress pattern recognition in mathematics.

DEVELOPMENTAL GOAL: To have students appreciate the need of keeping the goal of decision making always in mind, avoiding distracting goals, and of constantly evaluating each step of decision making in relation to the goal.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Identify the difference of two squares. 2. Factor these differences. 3. Consider various goals of work and investigate which goals can be realized by what careers.	1. Show transparencies providing illustrations of pattern identification in drawings from "noise" (Tech-People-Environment) T020403 2. Discuss machine vs. man as pattern recognizers. 3. Have students select the difference of two squares from a list of various binomials. 4. Show by an example of deciding the goal of a career for oneself that some careers contain the possibility of attaining the goal and others do not. 5. Have various speakers from different careers speak about what they get out of their work.	1. Transparencies of T.P.E. materials are available through the math office. 2. Book 1, Patterns in Noise.

SUBJECT: Algebra - Grade 9

PLAN XXXIII.

INSTRUCTIONAL TOPIC: Factoring Trinomials

DEVELOPMENTAL AREA: Self, Decision Making

INSTRUCTIONAL GOAL: To factor trinomials.

DEVELOPMENTAL GOAL: To realize that one is prone to impose unnecessary constraints on oneself, thus inhibiting effective problem solving; particularly in the self evaluation of ones abilities in considering a choice of career.

Performance Objective	Activities	Resource materials.
The student should be able to: 1. Factor trinomials such as: $x^2 + 4x - 5$ 2. List 5 skills that he or she has and careers that would use these skills.	1. Have student solve the following dot problems using these rules. a. Connect the 9 dots using four straight lines. b. Do not lift your pencil from the paper. c. Do not retrace any lines.	1. G.I.S. program.

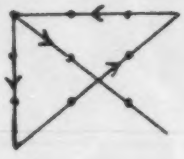
SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials
	Solution:  Point out that most people in attempting to solve this problem unconsciously impose on themselves the constraint of staying within the area of the square. 2. Factor trinomials such as $x^2 - 11x - 12$ stressing the need to consider unusual factors of the constant term as well as ordinary factors. 3. Have the student list his/her skills and abilities and careers that he/she thinks could use these qualities. The student should be encouraged to put down skills which they might not think worthwhile, stressing that there most probably exists some career requiring any skill.	

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials
	4. Bring in career literature listing skill requirement for various jobs.	

SUBJECT: Algebra - Grade 9 PLAN XXXIV.

INSTRUCTIONAL TOPIC: Quadratic Formula

DEVELOPMENTAL AREA: Employability and Work Adjustment

INSTRUCTIONAL GOAL: To apply the quadratic formula in solving quadratic equations.

DEVELOPMENTAL GOAL: To appreciate that many careers require the ability to give and follow instructions accurately.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Solve equations like $2x^2 - x - 1 = 0$ using the formula. 2. Recite the quadratic formula.	1. Develop and apply the quadratic formula to the solution of quadratic equation. 2. Stress that a formula is a set of precise instructions. 3. Have the student draw a continuous line starting at X according to the following directions.	1. Recipes. 2. Instructions for assembling furniture, toys, etc.

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials

a. 2 blocks up
b. 1 block to the right
c. 1 block down
d. 2 blocks to the right
e. 2 blocks up
f. 3 blocks to the left
g. 4 blocks up
h. 4 blocks to the right
i. 2 blocks down
j. 1 block to the left
k. 1 block up
l. 2 blocks to the left
m. 2 blocks down
n. 3 blocks to the right
o. 4 blocks down
p. 4 blocks to the left
q. What figure have you drawn?

SUBJECT: Algebra 8AA - Algebra 9A PLAN XXXV.

INSTRUCTIONAL TOPIC: Parabola

DEVELOPMENTAL AREA: Education and Training

INSTRUCTIONAL GOAL: To make the student aware of some areas of work which require a knowledge of coordinate geometry and specifically a knowledge of the two curves with the names of catenary and parabola.

DEVELOPMENTAL GOAL: To motivate pupils to use educational experiences as training for work.

Performance Objective	Activities	Resource materials
The student should be able to: 1. List various uses of the parabola and the occupations that are involved.	1. Discuss the implications of the parabola for someone who is a civil engineer. This could be done after the class has completed some work in graphing parabolas. When a uniform cable such as the cable of a suspension bridge is suspended between two points, it will form a curve which is called a catenary. When the roadway is suspended from this cable by lighter cables, the main cable will form a different type of curve. This curve will be a parabola. 2. Discuss other topics which might be related to the parabola. Listed below are some parabolas of rotation, e.g., reflector of a spot light reflector of an auto headlight radio antenna	1. Someone from the field of communication may discuss the use of the parabola in radio antennas.

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials
	radio telescope (world's largest moving radio telescope is at Greenbank, W.Va.) lens of a reflecting telescope (Mt. Palomar) If a light source or a sound source is placed at the focus of a parabola, the light or sound waves will be reflected along parallel lines (See drawing). This, for example, is demonstrated by the beam of light from a spot light. Also if light rays come to the parabola from a distance and are essentially parallel, all the rays are reflected to the focal point. This is the principle on which a reflecting telescope works. This same thing is true for light, sound, and radio waves.	

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

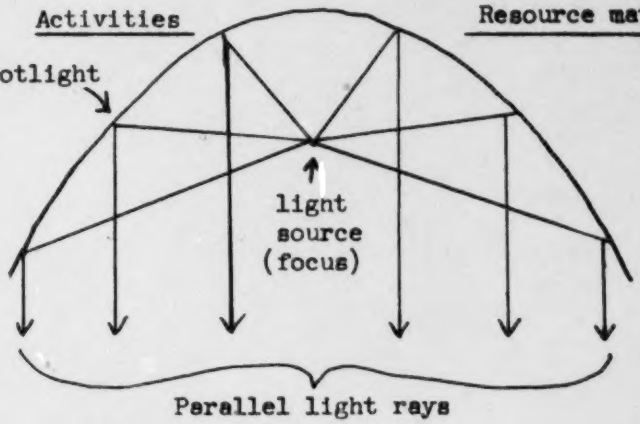
DEVELOPMENTAL GOAL:

Performance Objective

Activities

Resource materials

Cross section of a spotlight (parabola)



3. Interest the student in the fact that the path of a projectile, neglecting air resistance and wind, is a parabola.

4. Have the student demonstrate the use of a reflecting telescope.

5. Have the student do some research concerning the number of years of mathematics training that might be required to work in such an area.

SUBJECT: Algebra - Grade 9 PLAN XXXVI.

INSTRUCTIONAL TOPIC: Probability

DEVELOPMENTAL AREA: Decision Making, Self

INSTRUCTIONAL GOAL: To develop the concept of probability.

DEVELOPMENTAL GOAL: To develop an awareness in the student of the need for gathering data about himself/herself and about various careers in order to predict the degree of success he/she might enjoy if he/she chose that career.

Performance Objective	Activities	Resource materials
The student should be able to: 1. Define probability. 2. Calculate the probability of simple events. 3. List 5 personal qualities that would probably be useful in any career.	1. Have students consider rolling 2 dice, one black and one red. List the possible combinations that could result. What is the probability of each result? What is the probability of the various sums of the two dice that could result? 2. Have students roll the two dice noting and graphing the frequency of the various possible sums. 3. Have students compare each others results. 4. Have students calculate the probabilities of the total occurring from the data collected. 5. Apply the above activities to career development by pointing out that predicting the outcome of dice depended on the gathering of data.	1. Dice.

SUBJECT: Introductory Algebra - Grade 9 PLAN XXXVII.

INSTRUCTIONAL TOPIC: Probability

DEVELOPMENTAL AREA: World of Work, Education and Training

INSTRUCTIONAL GOAL: To help students understand how probability concepts are used in four job areas.

DEVELOPMENTAL GOAL: To provide an opportunity for students to listen and develop questions from presentations given by speakers.

Performance Objective	Activities	Resource materials
The student should be able to:	1. Discuss with the class some of the roles/functions of actuarian, insurance agent, meteorologist, quality control manager, race track odds maker, and how they use probability in their occupation.	1. G.I.S. program.
1. Write some questions to ask speakers.		
2. Write/complete a report on speakers presentation following the given format.	2. Have the students to compose several preliminary questions to ask the speakers on a day before speakers arrival, e.g.,	
Speaker's Name_____ Job Title_____ Job Duties_____ _____ Other highlights_____ _____ Student reaction_____ _____	a. What are some qualifications for a given job?	
3. Listen attentively to guest speaker's presentation.	b. How many years of education are needed?	
	c. Are there many females in your field?	
	d. What is the salary range?	
	e. What are your work hours?	

SUBJECT:

INSTRUCTIONAL TOPIC:

DEVELOPMENTAL AREA:

INSTRUCTIONAL GOAL:

DEVELOPMENTAL GOAL:

Performance Objective	Activities	Resource materials
	f. What are your dress requirements? g. What mathematics is utilized on the job? 3. Explain and idscuss with the class the overall format, e.g., each speaker will have a presentation about his/her jobs using posters, sound filmstrips/slides, and/or film. Some things speakers might discuss: a. How did he/she come about in making his/her job selection? b. Why does he/she like his/her work? c. How does his/her work help society? d. Are there many openings in his/her job area? e. What are some disliked things about your job? 4. Have student write a report on speakers.	

SUBJECT: Algebra - Grades 8-9 PLAN XXXVIII.

INSTRUCTIONAL TOPIC: Computer Programming

DEVELOPMENTAL AREA: World of Work, Education and Training

INSTRUCTIONAL GOAL: To develop a fundamental understanding of basic language and how to write simple programs.

DEVELOPMENTAL GOAL: To realize the importance of computers in future employment and the necessary background to enter the field.

Performance Objective	Activities	Resource materials
The student should be able to: 1. List five fields of employment where computers are used. (e.g., engineering, aerodynamics, traffic controller . . .) 2. List five jobs within such a career using computers (i.e., key punch operator, programmer) 3. Write simple programs in basic language. 4. List five institutions where a student can gain experience and education in computer technology.	1. Report on the history of computers (abacus---modern times). 2. Look up in classified ads to jobs related to computer operations. 3. Write a flow chart for an everyday occurrence (i.e., how to get from home to school, making breakfast, . .) 4. Write a flow chart to solve a specific formula. $C = 5/9 (F - 32)$	1. Library. 2. Newspapers. 3. Acquire services from data processing center at the Education Center. 4. Filmstrip, "Careers in Computers" available through Career Education Office.